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ABSTRACT

In the context of science, teachers reported reluctance to teach students with special needs, a university science teacher educator decided there was a need to conduct practitioner-research in an undergraduate, elementary/middle level teacher preparation program. Two courses were investigated. The first course was a general pedagogy course focusing on models and principles of teaching. This course was taught collaboratively by the science educator and a university special educator, and enrolled both general education majors and special education majors. The second course was an elementary/middle level science methods course that consisted of only general education majors. In both courses, the science teacher educator's goal was to assist threshold teachers (both general and special education majors nearing the completion of their teacher preparation programs) in developing the necessary competencies and perspective to meet the needs of their future students with disabilities, particularly those with developmental delays, in inquiry-based science classrooms. A strategy selected to achieve this goal was collaboration between the regular educator and a special educator. Collaboration was identified as especially helpful in planning and delivering effective science education to all students with disabilities. Another strategy selected was the use of a researcher-crafted scenario that depicted a student with a mental disability who had an Individualized Education Plan (IEP). Of particular interest to the science educator in both courses was to challenge by argument (ethically and morally) the cultural stigma of mental retardation as a possible reason for teachers' inclusion/exclusion decision making in the general inquiry-based science classroom. This study brings theory and practice together in praxis. Of paramount interest is an examination of the interrelations of theory, pedagogy, and the struggle for social justice. (MM)

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Preparing Prospective Teachers to Teach Students with Developmental Delays in Science: A Moral Perspective

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A paper presented in the symposium "Moral and Ethical Issues in Science Education: Is There a Voice for Research, Policy, and Practice" at the annual meeting of the National Association for Research in Science Teaching, New Orleans, Louisiana, April 6-10, 2002

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Preparing Prospective Teachers to Teach Students with Developmental Delays in Science:

A Moral Perspective

Abstract

In the context of science teachers reported reluctance to teach students with special needs, a university science teacher educator decided there was a need to conduct practitioner-research in an undergraduate, elementary/middle level teacher preparation program. Two courses were investigated. The first course was a general pedagogy course focusing on models and principles of teaching. This course was taught collaboratively by the science educator and a university special educator, and enrolled both general education majors and special education majors. The second course was an elementary/middle level science methods course that consisted of only general education majors. In both courses, the science teacher educator's goal was to assist his threshold teachers (both general and special education majors nearing the completion of their teacher preparation programs) in developing the necessary competencies and perspective to meet the needs of their future students with disabilities, particularly those with developmental delays, in inquiry-based science classrooms.

A strategy selected to achieve this goal was collaboration between the regular educator and a special educator. Collaboration was identified as especially helpful in planning and delivering effective science education to all students with disabilities. Another strategy selected was the use of a researcher-crafted scenario that depicted a student with a mental disability who had an Individualized Education Plan (IEP). Of particular interest to the science educator in both courses was to challenge by argument (ethically and morally) the cultural stigma of mental retardation as a possible reason for teachers' inclusion/exclusion decision making in the general inquiry-based science classroom.

This study brings theory and practice together in praxis. Of paramount interest is an examination of the interrelations of theory, pedagogy and the struggle for social justice.

Introduction

At the start of the new millennium public schools in the USA are characterized as serving diverse populations. A significant portion of the student population (approaching 6 million) is identified as disabled and eligible for special services. Disabilities include physical and health impairments such as speech, hearing, motor/orthopedic, and visual difficulties, and conditions eligible for special education services such as learning disabled [LD], mental retardation [MR], autism, traumatic brain injury, and seriously emotionally disabled [EH]. Data reported by the US Department of Education (1991) indicate that over half of students with documented disabilities are included in general education classes

It should be noted, however, that the inclusion of students with disabilities (particularly those with developmental delays) in the general classroom has not always been a distinguishing characteristic of the United States' public educational system. Instead, based on a prevailing mind-set for the majority of the twentieth century, the exclusion of students with developmental delays in particular was the typical practice. The exclusion of students with developmental delays in typical US classrooms gained widespread acceptance during the first decade of the twentieth after a campaign by the influential National Conference on Charities and Correction (NCCC) to eliminate access of the mentally disabled to their neighborhood public schools. The NCCC was acting on an exclusion recommendation made by the Committee on Colonies for Segregation of Defectives (Gilhool, 1998).

After a century of advocacy by parents of children with disabilities, special educators, and influential policymakers there exists currently substantial legal support for the inclusion of students with special needs (including those with developmental delays) in their neighborhood schools. Specifically, P. L. 101-476 (1997) [IDEA] and Public Law 101-336 (1990) the Americans with Disabilities Act [ADA] detail the educational rights of students with disabilities. Educationally, IDEA is the most encompassing legislative victory by advocates for students for disabilities who have long fought for appropriate educational opportunities for all students in the United States school system. While there remains considerable debate (Fuchs, Fuchs & Bishop, 1992) as to the

definition of "inclusion" (ranging from enrollment of all students in neighborhood schools with all necessary services being provided in the general education classroom to a more limited participation of students with disabilities that might entail separate classes in their neighborhood schools), considerable improvement in including students with disabilities in schools has transpired.

In addition to support from federal law, an analysis of the key science education reform documents indicates that support the inclusion initiative (McGinnis, 2000). References in the National Science Education Standards (National Research Council, 1996) to teaching students with disabilities unequivocally support all students' presence and participation in inquiry-based science classrooms. A central principle guiding the development of the Standards is "Science for all students" (p. 19). This is defined as a principle of "equity and excellence" (or "fairness") (p. 20) that strongly advocates science in schools for students with disabilities. In addition, all students are assumed to be included in "challenging science learning opportunities" (p. 20). This equity principle is reflected in Teaching Standard B: "Teachers of science guide and facilitate learning" (p. 32). In order to accomplish this, it is imperative that teachers: "Recognize and respond to student diversity and encourage all students to participate fully in science learning." "Students with physical disabilities might require modified equipment; students with learning disabilities might need more time to complete science activities" (p. 37).

The equity principle is also reflected in Program Standard E: "All students in the K-12 science program must have equitable access to opportunities to achieve the Standards" (p. 221). Actions to promote this include "inclusion of those who traditionally have not received encouragement and opportunity to pursue science" by "…adaptations to meet the needs of special students" (p.221). This equity principle is further reflected in Assessment Standard D: "Assessment practices must be fair.… Assessment tasks must be appropriately modified to accommodate the needs of students with physical disabilities [and] learning disabilities" (p. 85). This is not only an ethical requirement but also a measurement requirement.

Historically, teachers inclined toward inclusion (a minority of all teachers) have identified science classes as especially suited for students with disabilities (Atwood & Oldham, 1985). These teachers identify the perceived relevance of the content, the possibility for practical experiences, and the opportunity for group learning with typical peers as the strengths of science classes for inclusion purposes (Mastropieri, Scruggs, Mantziopoulos, Sturgeon, Goodwin, & Chung, 1998). However, this perspective does not mean that most contemporary teachers in science (or otherwise, see Welch, 1989) are sanguine about including students with disabilities in their classrooms. Instead, as reported recently by Norman, Caseau, and Stefanich (1998) both elementary and secondary science teachers identify teaching students with special needs as one of their primary concerns.

The Study

In the context of USA society in which the science education standards support inclusion but many teachers' report reluctance to include in their general classrooms students with special needs, I decided there was a need to conduct practitioner-research in an undergraduate teacher preparation program for elementary/middle level teachers. The courses investigated were a university general pedagogy course and an elementary/middle level science methods course. The focus of my study was an investigation of my prospective teachers' beliefs about and intentions for inclusive science education classroom practice, particularly for students with developmental delays. I was interested particularly in detecting if my students held moral considerations related to the inclusion initiative in science classrooms. Research on practice in a field setting by practitioners in that field is known as practitioner-research (Anderson & Kerr, 1999). A common focus of practitioner-research is to promote a self-reflective, systemic, and instrumental inquiry that can improve teaching practice and our understanding of practices. Practitioner-research can also take on a social justice or an emancipatory focus if the intent of the research is "to improve on the rationality and justice of their own social or educational practices, as well as their understanding of these practices" (Kemmis & McTaggart, 1988, p. 5).

I intended to use my investigation as a way to gain a deeper understanding of how my students' beliefs about inclusion/exclusion might impact their perception of culture and society and its impact on the school. With this new found understanding, I intended to craft a report in which I would document how I strive to live out my belief that as a science teacher educator I am not only a theorist but also a practitioner/teacher/parent influenced by moral considerations. This stance would permit me to engage in an autobiographical discourse advocated by curriculum theorists (Pinar, Reynolds, Slattery, & Taubman, 1995) that examines interrelations of theory and pedagogy and the struggle for social justice in theory and praxis.

The two undergraduate teacher preparation courses examined in this study contained students majoring in of one of two types of majors, general elementary/middle level teacher education majors and special education majors. Both majors were enrolled in the general pedagogy course; the science methods course contained only general education majors. My goal was for all of the future teachers (general and special education) to learn ways to collaborate among school professionals and to effectively teach inquiry-based science to students with disabilities (particularly those with developmental delays) in inclusive settings. A major goal was to foster a classroom environment that would enable me to challenge by argument (ethically and morally) the societal stigma of mental retardation as a reason for exclusion in the general science classroom. Being a parent of an elementary student with significant developmental delays provided the impetus for this stance. Thus, I cannot feign (nor desire) objectivity in implementing this study. To lessen the potential impact of this bias, I did not reveal to my students my personal connection to the disabled community.

Theoretical Perspectives

I conceptualized my study as an investigation of individuals acting within a culture (Aikenhead, 1996). Therefore, I decided to use the culture construct as a mediating or explanatory variable to interpret my students' moral decision making that resulted in the inclusion/exclusion of students with disabilities in science classrooms. Different theories have been proposed to explain the relationship between the individual and the society (Killen, McGlothin, & Lee-Kim, 2001;

Turiel, 1998). As an analytical construct, 'culture' has appealed to many theorists interested in understanding within a society an individual's actions and beliefs. However, since 'culture' is recognized as a multifaceted construct, it is necessary to identify the definition of culture one selects to use. I hold a definition of culture that is a diverse phenomenon with different meanings for individuals depending on the context (McGinnis & Simmons, 1999). As a result, I do not find it helpful to subscribe to macro theories of culture, in which culture is defined as a unified set of meaning systems. Instead, I conceptualize culture on the micro level. Culture is a significant source of influence on individuals. Therefore, in order to understand how cultures influence individual social judgments it is necessary to examine how different social categories contribute to an individual's evaluations of social events and interactions.

Secondly, since the premise of my argument is that there is a moral dimension (i.e., that of good/right or bad/wrong) to teachers' decision making concerning inclusion/exclusion of students from science classrooms, I reviewed the educational literature on moral issues. For the science education research community, Zeidler (1984) and Zeidler & Schafer (1984) outlined how moral reasoning could act as a mediating variable in understanding students' judgments concerning social policy (particularly as impacting environmental issues). Zeidler and associates based much of their thinking on the works of John Dewey, Lawrence Kohlberg, and James Rest. A key assumption they held (to which I gravitate) was that "education is a social means to a social end" (Zeidler & Schafer, 1984, p. 13). As a result of this assumption, they did not limit the purpose of science education to subject matter enhancement. Instead, they expanded the purpose of science education to include consideration of moral reasoning and its critical role in achieving scientific literacy.

Within the more general education literature, my interest in the connections among culture, morals, and teaching (both in teacher education and in the practice of teaching) led me to the works of Coles (1986), Goodlad (1990), Fenstermacher (1990), Strike (1990), Rest (Rest, Narvaez, Bebeau, & Thoma, 1999), Bebeau (Bebeau, Rest, & Narvaez, 1999), and Killen and her associates (Killen, et. al, 2001).

After reading Coles' work, I became more sensitive to considering the moral side of teacher preparation, including: a concern with explicating its ideals and values; a yearning to discern a sense of what is right and wrong; and, a need to hear prospective teachers state their ethical and moral positions on teaching. I also found considerable inspiration in Coles' thoughts to persevere in an extended investigation that looked at science teacher education from the relatively unexplored moral perspective.

From my of reading Goodlad, Fenstermacher, and Strike, I gained a more multifaceted view of how educational theorists conceptualize moral considerations and teaching. I also found they supported study of curricular innovation in teacher preparation that examined moral considerations. Goodlad (1990) stated an essential connection between morals and teaching. He defined the nature of teaching as moral. As such, he asserted that teachers must act ethically. Fenstermacher (1990) both supported and extended Goodlad's premise. He argued that it is the moral nature that gives teaching its purpose. He made the argument that moral qualities (compassion, care, fairness, love, and tolerance) are learned and acquired in the course of social experience. He defined the moral dimension of teaching as directly linked to teacher modeling of moral actions. For Fenstermacher, teaching is a moral activity because "it is a human action undertaken in regard to other human beings. Thus, matters of what is fair, right, just and virtuous are always present" (p. 133). Fenstermacher asserted that teachers must draw attention to what they are doing and why, hold it up for inspection, and by suggestion and demeanor, expect learners to follow along. While examining legal considerations of morality and teaching, Strike (1990) argued for the explicit instruction of ethics in teacher preparation. He identified the moral qualities of tolerance and appreciation of appropriate diversity among learners as two desired critical characteristics of all teachers.

Although I was not drawn to Rest and associates' neo-Kholbergian approach to investigations in moral thinking (Rest, Narvaez, Bebeau, & Thoma, 1999), I gained much from their methodological analysis of research in moral issues. Their warning that total reliance on participant interview data is insufficient when the goal is to gain insight into participants' reasons

for moral judgments encouraged me to seek additional data sources. Research by Nisbett and Wilson (1977) reported by Rest and associates throws into considerable doubt the direct link between individuals' words and their moral minds. That is not to assert that interview data is not important, especially during hypothesis-generation and in collecting think-aloud commentary on individuals processing of information, just that it is open to bias in elicitation and in interpretation. As a result, collaborating evidence is desired to accompany interview data when the intent is to draw conclusions on individuals moral thinking..

From Bebeau and associates (Bebeau, Rest, & Narvaez, 1999) I learned that current attention is being directed to research on moral education as a consequence of a resurgence of character education, first proposed in the 1930s. I also found Bebeau and associates' examination of researchable variables in moral education particularly helpful in interpreting theoreticians' selection of differing variables in moral education. Bebeau pointed out that the selection of differing variables by theorists was the result of their stance among a tripartite theoretical view of moral education. The tripartite theoretical view of moral education consisted of a psychodynamic psychology view (varibles: guilt, shame and self-esteem), Kohlbergean/Piagetan view (variables: stages of moral development); and a behaviorist view (variables: resistance to temptation, aggression, helping and prosocial behaviors). Bebeau and associates also reported that the tripartite view was contested, suggesting that other theoretical views might be more fruitful.

Finally, from my reading of the works by Killen and her associates (Killen, McGlothlin, & Lee-Kim, 2001; Killen & Stangor, in press) I gained a deeper level of understanding of how individuals in a culture engage in the process of determining inclusion/exclusion of persons with disabilities in school settings. Killen and her associates credit Minow (1990), who examined inclusion/exclusion in the context of American Law, for their theoretical view. Killen et. al (2001) view the balancing concerns of the individual and concerns of the group a common experience, part of being a member of a culture or social group. Killen and associates believe that individual and social goals vary by context, not as a function of national or social identity. Their model of moral development is domain specific and in contrast to Kohlberg's (1984) theory that

characterizes development as a series of global stages or levels across all contexts. Killen and associates posit that decisions about the appropriateness of excluding learners from social groups involve two forms of social reasoning: moral beliefs about the wrongfulness of exclusion, and social-conventional beliefs about group processes and group functioning (dimensions that bear on exclusion). Moral beliefs include concepts about fairness and rights, equal treatment, and equal access (Turiel 1998). Social-conventional beliefs entail several forms of reasoning, including those that concern group functioning (Turiel, 1983, 1998), group identity (Brown, 1989) and stereotypes about others based on their group membership (Stangor & Ruble, 1989; Stoddart & Turiel, 1985).

Research on children's reasoning about social conventions has shown that their views change with context, particularly so in terms of taking social group roles and expectations into account (Killen, 1991; Theimer, Killen, & Stangor, 2001). Young children reason about social conventions in terms of social uniformity and rule systems; older children reason about social group customs in terms of societal standards and social coordination. With age, children become increasingly concerned about the nature of social groups, the norms and expectations that go along with the structure of the group, and effective group functioning. Theoretically, then, decisions about potential exclusion from social groups involve the coordination (competing) of moral judgments about the wrongfulness of exclusion with a range of social-conventional judgments about social group functioning, group identity, and group stereotypes. In their work, Killen and her associates investigate inclusion/exclusion decision making by context. Contexts vary between a straightforward exclusion context (prototypic, based solely on social conventional reasoning), and a multifaceted context (complex, characterized by an increased cost to social conventioning, i.e., group functioning, and a decrease in the morally-relevant salience of the exclusion decision). Killen and associates reported that in multifaceted/complex situations consideration of social conventions were used to justify exclusion, such as evaluating qualifications of individuals that potentially impact group functioning. Killen (Killen, McGlothen, & Lee-Kim, 2001) concluded that one way to promote change regarding exclusion is "to introduce arguments that focus on the

fairness and moral dimensions of exclusion, particularly in situations involving stereotypic expectations" (p. 30). Killen and associates warned that research by Stangor & Schaller (1996) indicated that changing stereotypes held by adults is more difficult than changing those held by children.

The Curricular Innovation

During the two semesters that I taught both courses, I strove to engage my students in self-reflection in a public setting. Essentially, I wanted them to become moralists. Moral purpose and moral stances became my preoccupation. I wanted to explore my students' moral considerations in the context of the culture in which they lived and in which they desired to teach. I believed my students were observing me, each other, the teachers in their school placements, and were rendering moral judgments on which students should be taught science and how. My students' teacher education program was silent on formally exploring morality. Therefore, their views on the morality of teaching science to children with disabilities (particularly developmental delays) in inclusive settings were shaped and articulated in their teacher education program as a result of their experiences in the courses that I taught.

I resisted looking for moral accolades to advance my personal agenda to promote social justice. I hoped to encourage new moral considerations in my students who came to me resistant to inclusion while simultaneously validating the moral stances of those who already held an inclusive view. I aimed to create an environment that fostered ethical choices. For example, similar to Coles (1986), I thought new moral stances would emerge from my students as a result of considering a "new situation that holds a larger promise" (p 35) for all learners. In addition, I avoided the use of perceived coercive fiats (such as federal laws and the science education standards recommendations) in my quest to engender acceptance and perhaps even enthusiasm for the inclusion of students with disabilities (particularly those with developmental delays) in science classrooms. Instead, I concentrated on ways to focus attention on their beliefs concerning the inclusion/exclusion of students in science and, by argument (morally), to challenge exclusion decisions.

In both courses, I needed to create a teaching context that would permit examination of my students' inclusion/exclusion decision making. The strategy I selected to achieve this goal was a collaborative model of inquiry-based science lesson plan development and small peer group performance. In the general education course, cooperative groups consisted of four general educators and one special educator. In the science methods course, cooperative groups consisted of only general education majors. The prospective teachers were challenged to include to the extent they felt appropriate a case study student with a mental disability. Working together, the university special educator and I generated a scenario of a student with a mental disability. We named her "Nina" (Appendix A contains the case study scenario). Following presentation of the lessons to their peers in class, my students were required in journal format to reflect on their inclusion/exclusion considerations and on their efforts to plan for the inclusion of a student with a mental disability in a inquiry-based science lesson.

As a way to prepare my students to prepare and deliver inquiry-based science lessons, I modeled the cognitive/constructivist-based instructional model in a series of inquiry science lessons with them as learners that investigated the physical science topics heat and temperature. The lessons were characterized as problem-based, with an emphasis on student reflection, active student participation in data collection and reporting, and consideration of alternative methods of problem-solving and assessment. Throughout these lessons, I discussed how I would plan to include a student such as Nina in the science content lessons. I guided my discussions by use of a student handout that I crafted on research-based recommendations for inclusion of students with disabilities in science classes. Appendix B contains this handout. In particular, I put an emphasis on a combined curricular adaptation and accommodation possibility of "same activity, with adapted expectations and emphasis on embedded skills." I recommended that she be placed up front in the class and work in a cooperative group. I also recommended consultation with a special educator to gain pedagogical ideas on her inclusion, and my university special educator co-instructor assisted. She recommended that Nina have a buddy or an aide to assist her as needed to stay attentive and cognitively engaged. She and I both emphasized the need for Nina to develop measuring skills in

the investigation and for her to practice communication skills with her peers and in written responses. We recommended that the investigation activity sheet be adapted to her reading level and enlarged for ease in decoding. Finally, we stressed how early sharing of the lesson with Nina's parents (who would be consulted as to additional suggestions) and who could prepare Nina for the activity prior to the lesson, might enhance Nina's later class participation and performance.

In contrast to my actions, the university special educator with whom I collaboratively taught the general pedagogy course placed her attention on an overview of the major US laws relating to special education and on formal instruction on five models of inclusion. The inclusion models she taught ranged from full inclusion to separate special education classes in a neighborhood school for students with profound disabilities. She advocated for inclusion as a legal right separate from our students' decision making. She taught this subject matter in lecture format over a five-session sequence. She modeled direct instruction in her teaching.

In my science methods course, I continued the innovation of requiring the collaborative development and peer teaching of four lesson plans (physical, life, earth, and integrated content, respectively) that included overt adaptations and accommodations for students with disabilities. To facilitate this requirement, I used the same student scenario developed for the general education course ("Nina") and added five more scenarios of students with other disabling conditions (including physical and emotional). I also gave them the handout I crafted on research-based recommendations for inclusion of students with disabilities in science classes. In all lesson planning activities, I encouraged my students to collaborate with the special educators who worked in the same professional development schools in which they were placed twice a week. To facilitate this collaboration, I required my students to read independently, and then to participate in a class discussion that examined in detail the journal article "Diversity, the science classroom and inclusion: A collaborative model between the science teacher and the special educator" (McGinnis & Nolet, 1996).

My aim in using the peer teaching technique in both courses was to put my students in the role of moral witnesses, to identify the aspect of the lesson that pertained to inclusion and consider it from an ethical perspective (i.e., make statements on right or wrong).

Participant Reactions

Throughout both courses student self-reflection was cultivated. The preservice teachers were given ongoing opportunities to comment and reflect on the diverse strategies used in enacting the curricular and pedagogical innovation. In-class data sources consisted of participant written reflections, survey, and class discussions. Out-of-class data sources consisted of reflective journal entries and semi-structured interviews (audiotaped and transcribed).

Student reactions to the curricular innovation are presented in two sections: Reflections on planning science lessons for a student with a mental disability and Reflections on inclusion/exclusion decision making. I analyzed the data through the use of the qualitative technique of analytic induction to construct patterns of similarities and differences between the participants (Bogdan & Biklen, 1992; LeCompte, Millroy, & Preissle, 1992). This procedure included careful reading of all the data to develop a more global perspective. In both sections students' moral considerations were detected as well as additional considerations. For heuristic purposes, categories of reflections are presented as themes (four for section one and two for section two) that are illustrated by exemplar student quotations.

Section One: Prospective Teachers' Reflections on Planning Lessons for a Student with a Mental Disability

A pattern of response that my students (general and special education majors) expressed in their reflections on planning science lessons for a student with a mental disability was that it was 'right' or 'fair' for my students to face this issue in their teacher education program. Their moral stance pervaded their reflections of the two courses, and prompted several unanticipated conversations during class sessions on the moral dimension of teaching. For a few general education majors, the stigma of mental retardation emerged. They expressed uncertainty in teaching a student with a mental disability, specifically Nina the case student who had Down syndrome, in a

content area (science) they personally considered academically challenging. The majority of the majors, however, expressed optimism in attempting adaptations and accommodations for Nina in their science content lesson plans. For most of my junior and senior level general education majors, these class conversations were the first opportunities they had been given to discuss this issue with appeal to moral concerns in their teacher education program.

I found my students' journal reflections illuminating, and oftentimes encouraging in their support of my belief that the inclusion initiative in science for students with disabilities, particularly those with developmental delays, was intimately related to moral considerations. In regard to my students majoring in special education, I learned that while they had previous opportunities to discuss both moral and legalistic considerations regarding inclusion they were more ambivalent than were my general education majors as to the benefit of inclusion. They expressed more anxiety as to whether the inclusion educational initiative was a good or right direction for science education to take, particularly for a learner with a significant mental disability.

A tension that emerged in the general education course between the merits of a cognitive/constructivist pedagogical perspective (favored by me and almost all of the general education majors) and behaviorism (favored by my special education co-teacher and all the special education majors) surprised me. I had not anticipated that there would be so much disagreement about the pedagogy of science instruction in inclusive classrooms based on a philosophical perspective of knowledge and principles of teaching. The opportunities for student reflection and public discourse my co-teacher and I provided in the general education course allowed the difference in perspective between the two different camps of thought to emerge and to be debated. I came to think of the difference in perspectives that we held as a "paradigm war." I decided that the most that could be accomplished in the general education course was a recognition that this major difference existed between the disciplines of science education and special education (at least at my institution). I accepted that this difference in perspectives (if it existed at other institutions) would most probably have a profound impact (as yet not understood) on a collaborative model of teaching practice in inclusive science classrooms. I also came to believe that the differing views the two

majors expressed on who benefited from the curricular innovation of a combined general education course (general education and special education majors and professors) was related to that philosophical disagreement.

Theme one: *It is right/fair to make plans to include a student with a mental disability in a general science class.*

Exemplar voices:

I never realized until this course that I might have deaf children, or children with serious emotional disorders, or even those with mental retardation such as Nina in the classes I will teach. I didn't even realize that children like Nina could actually be put in my science classroom. I've never even known any people who have Down syndrome and those round faces. I now think *it is right* [emphasis added] that they can be taught in the general education classroom (Erica, general education, general education course, class conversation)

A big concern I have is that until this course, I didn't realize (and I'm a senior!), I didn't realize how much inclusion there is now in the schools-especially in science, a subject that I have found challenging! I don't think we've been told about it enough. I know I wasn't prepared. I think this is a big hindrance, because as teachers we want to reach all of our children, because that *is what is right* [emphasis added]. (Felicia, general education, general pedagogy course, end of semester interview)

Theme two: *It is right/fair to share expertise in planning instruction for students who need support in academic settings, including students with developmental delays in science.*

Exemplar voices:

I thought it was very helpful to be exposed to what the special education majors have learned in their course work and to provide some input in our group lesson planning. And they provided a lot of helpful information to me. And maybe there was an aspect that I had not really thought about in my science activity, but at any rate, they shed some light on it.

The special education majors, they just sort of like modified things a little bit that I didn't really know how to do. They also got a taste for just sort of what a general classroom would be like and the science curriculum (Phyllis, general education major)

I worked with Betty [a special education major], and we were doing our team teaching. She was going to use lecture to deliver science content. The two of us regular education majors with a science concentration gave her some ideas on how to have the students use science equipment to solve problems instead of just memorize some facts. And in turn, she also gave us some ideas for interacting with our case study Nina such as providing her more information. (Susan, general education major)

Working in cooperative groups, of course, you always learn from each other, but having a special education major in the group you learn a lot more about what they've learned about special education, and they can answer questions you might have on how to apply a method, or how to teach a subject, or what to do with a student with a disability, such as mental retardation. (Carol, general education major)

Well, I think that it is great to be in an inclusive course (regular ed and special ed majors), because we're so separate right now. It's really neat to get ideas of how they are feeling about going into inclusive classrooms and practicing making accommodations for our case study student (Nina) in the regular science class. I learned a lot about regular educators, so this type of course was really beneficial to me in my special education program. (Stacy, special education)

I was the only special educator in my group, and so I heard how the other three regular education majors express how they felt about preparing an inclusive science lesson. It was, like, neat to personally experience that. It was a *good thing* [emphasis added]. And it was

also nice to hear them ask me questions, such as "How do I do this?" and "What should I do?" It kind of made me feel important, I guess, in a way. Like, I could help, and we kind of helped each other out a lot. (Justine, special education major)

The two of us, when we worked together on our lesson plan, I thought it was real important because she kind of got to see where I was coming from, because I really come from a different place than she does when she's thinking of her teaching and how she wants it to go, and how I want it to go. So combining the two (special ed and general ed), I think is *right* [emphasis added]. (Angeli, special ed)

Theme three: *There exists a paradigm battle between the fields of special education (behaviorist perspective expressed in direct instruction) and general education (cognitive/constructivist perspective expressed in small group problem solving and posing).*

Exemplar voices:

I think it probably was good for the students majoring in special education to see other ways of teaching outside of Direct Instruction. Because, in an inclusion science or mathematics classroom when they come in and work with a general educator, they're gonna need to know how to help run a constructivist classroom based on inquiry, and not just stand up there and lecture. And that takes practice and some thinking. (Sam, general education major)

The regular education majors just seem very content oriented. Like, you know, like "I am a science or mathematics teacher" who thinks all students should do experiments and stuff instead of like a person who wants to teach students like Nina. What we students majoring in special education bring to the course and to our collaborative micro-teaching is more of a general understanding of functioning of children with disabilities and how to structure their learning in direct ways, such as by giving clear directions and by telling the information they are expected to learn. (Michelle, special education major)

Theme four: *What benefits are there from collaborative science lesson planning for the special educator and the general educator?*

Exemplar voices:

I think, and I'm not sure if I'm right on this, but as a regular ed majors, we're gonna be exposed to special ed, but as special educators, they're not as exposed to regular ed. So I think we're more interested in learning about special ed than they are about regular ed. It just seems like they're just starting to learn content, like science, to teach while we know the content and want to know what they know. (Pat, general education major)

I think the special education majors have a very narrow definition of what they're going to do. I mean, anyone who goes into the Severe and Profound program is a really special individual. But I think in talking with a few of them, I think some of them think they're going to be kind of the resource teacher, a separate entity in the school. That teachers are going to come to them. I think their vision of their role in inclusion is kind of narrow. They need to see how the general education teachers teach science (and mathematics) through problems and how students who are not disabled learn. (Bill, general education major)

One of the students majoring in special education (concentrating on the Severe and Profound), I mean, she made a joke, like, "My role is gonna be just to change diapers," or something like that. Or "give them a cookie if they're good," or something. And maybe she was joking around, but it seemed to me that she was focusing more on behavioral issues, not science content issues. She really needs this course to learn about inclusion based on the regular curriculum. (Jessica, general education major)

As a special educator at this university, we're not trained in any one content area at all. That makes working in a content-driven inclusion class hard. However, we take courses on

classroom management training that the general ed folks do not (Stacy, special education major)

Section Two: Prospective Teachers' Reflections on the Inclusion/Exclusion of Students with Developmental Delays in Science Inclusive Settings

Throughout the two courses, I was interested in promoting and listening to my students' ethical and moral considerations concerning the inclusion/exclusion of students with developmental delays in science. Since I gave them the case study scenario of Nina as someone to plan for inclusion in their science lesson planning and small group presentations, I presented them with a pedagogical situation that they had to react. Almost all of my students referred to Nina in their science lesson plans, although a few, approximately 5% did not. When I questioned them as to this omission, the prevalent response was that they expected that any modifications for students with IEPs would need to be done by a special educator, not them. For the overwhelming majority that did refer to Nina in their plans, they were asked to comment on their inclusion attempts in a post-lesson reflection or in an end-of-the-semester interview that was audiotaped and transcribed. By reading carefully all my students' reflections and comments, I was able to detect common themes.

Two major themes explored ethical and moral considerations of inclusion/exclusion. Most of my students expressed a moral belief that it was right or fair to include students with disabilities (including those with developmental delays) in the general science classroom. The most prevalent reason my students provided was a commitment to an inclusive and diverse society and culture rather than to a commitment to science literacy for students with developmental delays. For those who felt the opposite (a number of whom were majoring in special education), that it was right or fair to exclude students with developmental delays from the general science classroom, the reasons varied. A few believed that the science content matter was too challenging for students with developmental delays; some believed the students without IEPs would be negatively impacted academically by students with developmental delays; a few more believed that a separate class for students with mental and other disabilities more closely matched the special educators' vision of their role; most were concerned that the needs of the students with developmental delays would not

be met in typical classrooms. Since all of these reasons had been raised in class discussions during the courses, I anticipated that not all of my students would be supportive of the inclusion of students with developmental delays in the general science classroom. Gratifyingly, however, the number of students who ended the semester expressing exclusionary moral reasons were few compared with those who entered the courses expressing similar moral reservations.

Theme five: *It is right/fair for students of all abilities (including students with developmental delays) to be included in the general science classroom:*

Exemplar voices:

I think inclusion *is good* [emphasis added]. For regular ed children it teaches them social responsibility towards each other and helps them realize that everybody is different. And if they're exposed to it then they have to learn how to maturely deal with each other and understand the differences. And, I think socially *it's good* [emphasis added]. They become more aware of differences that people will have in the real world, and they'll be able to deal with each other with a higher level of maturity. And for the students in special education, I think it's *good* [emphasis added]. They get exposure to regular education kids and they're not in such a confined world, because when they get older and they're in the real world, it's not gonna be just their parents and their special ed instructors and their special ed friends, and so I think it exposes both in a good way. (Cline, regular education major, post-lesson reflection)

I think there are different advantages of inclusion for different students which makes it the *right thing to do* [emphasis added]. For the students with special needs, they get to feel like they're actually human, which is a big plus, *a good thing* [emphasis added]. They get a chance to make friends, to develop the social aspects of the education which might be missing. I know that if they're sent to special schools, then all they interact with are their teachers and the other students with special needs, and that may stunt their development. I know that kids can be cruel, and sometimes inclusion probably backfires, but I think just

having those students with special needs around the other students it makes them aware that the world is made of many different types of people (such as Nina), so I think that's a big advantage for everyone, *the right thing to do* (Pat, general education major, general course, end of semester interview)

I think the whole theory behind inclusion is great, and that kids with disabilities and kids without disabilities get to work together and really learn about each other. And as far as some social aspects it seems *to be good* [emphasis added]. I worked with a student with special needs last year. At first I was really concerned about his educational needs being met. However, the other kids in the class loved him, and every time he would do anything, make one step forward, they would just cheer for him. Even yesterday, I saw a fourth grade kid who has a mental disability (Down syndrome), and he read his book report in front of the class, and of course, his book report wasn't up to the level of the rest of the class, but he still did what they were doing on a different level, and they all just went crazy and cheered for him. I think it is just great, you know, that they're getting out and mingling in the world and getting some of that experience. (Stephanie, special education major)

Theme six: *It is right/fair for some students to be excluded in the general science classroom.*

Exemplar voices:

I guess the constraint I see with inclusion is if the needs of the child are being met in the regular ed classroom as far as educational needs and behavioral needs. It seems like, at least from the experience that I have had, they kind of get left out. And the teacher doesn't really focus attention on them, just lets them do whatever, so they're not being worked with really. It is *not a good* way to go [emphasis added]. (Michelle, special education major)

First, I'm very grateful to have this class, because this is the only education I will have, or at this point have had, in terms of being exposed to what I may encounter in inclusive

classroom. I am a senior now. So for quite some time I was concerned about not having explored an inclusive classroom, and I have to admit that I wonder *if it is right* [emphasis added] to go this way in education, especially in science and mathematics-- two of the harder academic subjects. (Susie, general education major, general education course, end of semester interview)

I remember when we first got into our cooperative learning groups in class, one of the regular education majors said, "I don't want those kids [case study student with special mental retardation] in my classroom." And another time, a student said she wasn't worried about the child with special needs getting her needs met. She was more worried about the children without disabilities getting their needs met when the student with a mental disability [Nina] was in the classroom. The future teacher was worried about the distractions that student could cause and that kind of stuff. That was enough for me. It just was *not right*. [emphasis added] I told her, "You should be worried about meeting the needs of her [Nina], too, you know? (Justine, special education major)

The regular ed major said something to the effect of, "I don't...I don't want kids like Nina in my class, they don't belong in regular science classes." And I took a deep breath, and I kind of turned my back for a minute, and then I turned back around and I said to her, "Well, I'm really sorry you feel that way. It is *not right* [emphasis added] to exclude kids in a blanket type of way" (Jill, special education major)

Those of us majoring in special education see so clearly how little the regular education majors know about special education. When they go out into the classroom, their principal is gonna come to them and say, "Guess what? Nina whoever is going to be coming into your classroom, and she has mental retardation, and here you go." I believe at that point the regular ed teachers are going to freak out because they don't have any information (up to

> this point in their program) to go on, and I think that's really unfortunate for them and a disaster for the kid with the disability included in the regular classroom. (Nancy, special education)

> I think the inclusion initiative it has kind of changed from when I wanted to be a special ed teacher. Because when I wanted to be a special ed teacher, it was a self-contained sort of thing. I would have my own little class, my own little students. But now, with this inclusion movement, I realize that it's not going to be as self contained as I hoped and certainly not as good for kids with disabilities as it could be. (Angeli, special education major)

Participant Actions

Because I was aware of Rest and associates' (1999) advice to obtain collaborating evidence to accompany interview data when the intent is to draw conclusions on individuals moral thinking, I collected systematically copies of my students' science content lesson plans. These copies included their reflections on including Nina, who was described as mentally retarded in her IEP, in their science lessons. Science topics presented in the lesson plans included an array of content (physical, life, and earth/space science) recommended by the science Standards for grades 1 to 8.

Upon review of my students' lesson plans (a total of fifty-seven), I found it helpful to categorize in patterns the various ways my students planned to include Nina in their science lessons. I report those categories in a continuum fashion, from most to least common (refer to the Figure). The most common modifications for Nina were use of a buddy system, administrative aide, and alternative assessment. I found it insightful that some of my students made no modification efforts to include Nina. They argued that their inquiry-based science lessons already included techniques that facilitated the inclusion of all students (regardless of ability): the use of small cooperative groups; the use of a problem to gain students' attention; and the use of science equipment. Very few of my students referred to collaboration with a special educator or to Nina's caregivers as sources of modification ideas.

Of special interest to me were the instances of moral considerations that my students expressed when they reflected on the inclusion/exclusion of Nina in their science lesson planning. A theme for those who made efforts to include Nina (the majority of the total) was that it was good or right to include her for two main reasons: 1) the modification process promoted the development of more effective science lessons for everyone; and 2) social justice considerations that were supported by current law. A theme for those who wanted to exclude Nina (a small minority of the total), was that it was not good or right to include her since it was assumed she would negatively impact the majority of the other students' academic performance.

Theme seven: *It is good or right to include Nina in the general science classroom.*

Exemplar voices:

> At first, I really did not like the idea of trying to make my science lesson more tailored for "Nina," even though I know it is likely that I will have to do something like this in my own classroom. In doing it, though, it caused me to think more critically about how my lesson would work in the classroom that would be better for the whole. After doing this, I now feel like because my class could only be better overall with a child, or children, with special needs that it is a good thing to do. (David, general education major, journal reflection)

> After going through the process of planning a lesson for a child with a disability [Nina], I feel that it important for children such as Nina with special needs to be a part of a regular classroom so that they can be a part of what society is filled with, people of all types. It is important that children have the opportunity to be around people different from themselves, so they do not get a closed mentality of who people are. (Sherry, general education major, journal reflection).

Theme eight: *It is not good or right to include Nina from the general science classroom because her presence will hurt the others academically.*

Exemplar voice:

> Planning my science lesson to include Nina was really hard to do. I do feel a conflict. I wonder how a teacher can possibly meet the needs of every student in a science class (particularly if it is inquiry-based and not lecture-based) if these students have such a variety of needs and abilities, such as Nina? How can a teacher take care of them at the same time? I don't think it is right to include students like Nina if it hurts the other students' academically. (Tina, general education major, journal reflection)

Discussion

Similar to Coles' (1986) conversations with younger learners, I view my curricular innovation as much larger in scope than two courses, one professor, and his students who aspired to be classroom teachers. I view it in an historical, societal scope: What is the nature of our morality in regard to establishing access to science education for students of all backgrounds and abilities, particularly by those with a mental disability in twenty-first century US public schools? How inclined are prospective teachers to support inclusion of students with developmental delays in science classrooms? A moral challenge science educators face as a discipline operating within a society is to decide on how (and to what extent) to include students with developmental delays in the general science classroom. Although the law protects the educational rights (including the least restrictive placement) of students with developmental delays, the reality of schooling is that the role of the classroom teacher as someone who does or does not support the inclusion of a student with a mental disability is critical to take into consideration. Therefore, the identification of moral conflicts associated with the general and the special educators' teacher's decision making is a critical step to accomplish.

During my extended study, I became aware of the great extent that all prospective teachers were caught between the complex and frequently contradictory worlds of their personal beliefs and the expectations of the law, the schools, and the families of children with disabilities. They were buffeted by the oftentimes conflicting educational initiatives to increase all students' science achievement on standards-based tests and to promote inclusion of all students (many of whom face significant academic challenges as measured by standardized tests) and acceptance of student

differences. They were caught between learning how to teach large social groups while preparing for individual diversity. Finally, a few were faced with acknowledging a deeply held belief that involved a stigma associated with students with a mental disability while being taught to value each and every student as a science learner. I see now how some of my students were engaged in a large moral struggle, discriminating between important and less valuable moral signals as they were challenged in their teacher preparation program to plan and implement inquiry-based science lessons.

I began my study with the intention to use my investigation as a way to gain a deeper understanding of how my students' beliefs about inclusion/exclusion might impact their perception of culture and society and its impact on the school. I learned that for most of my students moral considerations predominated in their professional decision making concerning the cultural and societal inclusion initiative. My students' caring attitude, particularly as associated with their instructional and placement decisions in science for students with developmental delays aligns closely with Noddings'(1986) and Valli's (1990) conceptualization of teaching (and becoming a teacher) as moral activities. Noddings (1986, p. 498) described the acceptance of "the caring attitude as a moral attitude" as a notion rapidly gaining acceptance by those who viewed teaching as occurring within a community. Valli (1990) described a reflective approach to teaching practice as relational if "caring teachers" asked "themselves what effect their choices are having on particular students" (p. 52).

Similar to Killen and her associates' (2001) study with a non-teacher preparation population, I conclude that my general education majors' inclusion/exclusion consideration for a student with a mental disability in the general science classroom depended on to what extent social conventioning considerations (i.e., group functioning) predominated. I believe that the effort I made in my courses to promote discussion and reflection of fairness and other moral dimensions of inclusion/exclusion (prompted by the use of a case study student with a mental disability crafted to reveal stereotypic expectations in my students) was instrumental in promoting change for some regarding the exclusion decision.

I learned that my general education majors who justified an exclusion decision evaluated the qualifications of a learner with a mental disability as impacting negatively group functioning. For my students majoring in special education, those few who supported exclusion did so out of a consideration for what they believed was right for the student with the disability, a separate environment in which they could meet their educational needs. For my students who supported inclusion, they justified their decision on a single moral consideration. They believed that all students would benefit socially from the inclusion of a student with developmental delays in the general science classroom. Furthermore, they believed that society would ultimately benefit from the inclusion.

Notably missing from my students' justification for the inclusion of Nina in the general science classroom was an expressed moral consideration based on the academic benefits for her in an inclusive science classroom, a focus of the science education Standards. An examination of the ways my students made attempted to modify their science lessons supports this finding. In the majority of instances when my students supported the inclusion of Nina into their general science lessons, the pedagogical action they took was to have others (peers or an aide) provide her social support. It was rare for my students to use any of the shared recommended ideas to meet Nina's intellectual needs (operational and science content knowledge).

As is often a result of practitioner research, I end my study with a new question. How can science teacher education encourage prospective teachers to reflect on their moral stance in regard to both the social *and* the intellectual benefits of inclusion for students with developmental delays in the general science classroom? I now believe that a first step is moral awareness of the benefits of intellectual outcomes of science education for students of all abilities. I concur with the moral theorists who state that to prepare a good teacher, one must bring problematic moral matters up to them and provide opportunities for their reaction. This is the moral work of science teacher education. As a field, science educators are in moral jeopardy without a moral perspective in making decisions on the inclusion/exclusion of students with disabilities, particularly those with developmental delays, in the science classroom.

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Appendix A: Nina, A Case Study Student with a Mental Disability

Nina is a student who needs support in an academic setting. Nina has Down syndrome and is eligible for additional resources as described by her Individualized Education Plan (IEP) According to Federal eligibility guidelines, she is classified as having "mental retardation" and is eligible for special education services. Nina has a moderate hearing loss. Her hearing loss has affected her language acquisition since she has had difficulty hearing the language around her. Some classmates find her difficult to understand because of her difficulty with expressive language.

Nina enjoys social settings and is typically friendly to her classmates and school personnel. Nina communicates through vocalizations as well as some simple sign language. This is the first year Nina has ever been in general classroom education setting for science. She is used to being in classrooms populated only by students with disabilities. She is excited about being in the general education classroom.

Appendix B: Class Handout on Ideas to Include Students with Disabilities in Science Classes

Key insights from the literature:

1. The manner in which a student with a disability participates in a science lesson will vary with the style of the lesson as well as the content area.
2. There is never just one way to involve successfully a student with a disability in a science lesson.
3. A collaborative model of instruction that draws on the expertise general and special educator classroom teachers offers much promise in meeting the needs of students with disabilities.

General Recommendations for the Classroom Teacher

Make adaptations and accommodations to include students with disabilities according to these four possibilities (ranging from the most preferred to the least) based on the ability of the student:

1. Same activity with adapted materials or expectations.
2. Same activity with focus on embedded skills.
3. With the group, yet working on a different activity for a different purpose.
4. Working in another part of the room on a different activity.

Specific Adaptations to Use (as Needed with a Particular Student):

1. Classroom Environment. Assign preferential sitting. Alter physical arrangement of the room. Reduce or minimize distractions. Have present a special education teacher or aide in the classroom. Use behavioral contracts.

2. Presentation of subject material. Pre-teach vocabulary. Use manipulatives. Demonstrate concepts. Tape lectures for playback. Use small group instruction. Use a multi-modal teaching approach that includes auditory, visual, and tactile modes. Use a parallel curriculum. Check often for understanding. Have student repeat directions.

3. Assignments. Adapt readings and activity sheets to match the reading/comprehension level of the student. Use written backup for oral directions. Shorten the assignment. Give directions in

small, distinct steps. Read the directions to the student. Use a school/home assignment sheet. Use an alternative assignment.

4. Assessment. Modify format. Shorten test length. Require only selected test items be answered. Allow student to answer orally. Modify grading system as appropriate to match the student's individual educational plan.

Recommended Readings

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Figure : A Continuum of Ways Used by Prospective Teachers to Include a Student with a Mental Disability in an Inquiry-based Science Lesson

Most Common ——— Least Common

Use a buddy system.

Use an administrative aide to assist with behavior management.

Use alternative assessment.

Sit student near front of the class.

Place the student in a cooperative group.

No modifications required due to the nature of the lesson (i.e., small groups, problem-based, use of equipment).

Use multiple modes of communication.

Pre-teach vocabulary.

Provide the lesson plan for early review to the student and her caregivers.

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